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The Army's MANPRINT (Manpower and Personnel Integration) program is a management and technical effort to integrate soldier performance and reliability issues into the materiel development and acquisition process. The program accomplishes this by continuously integrating information from the six soldier-related domains of MANPRINT--human factors engineering, system safety, health hazards, manpower, personnel and training. Contributions from engineering, logistics, MANPRINT and other disciplines are balanced in the "best value" goal of the procurement process. Accordingly, this document is offered as a supplement to other, more comprehensive guidance on source selection. The objective of this guide is to aid members of SSEBs in identifying and evaluating the MANPRINT content of proposals that are received from industry. Secondary objectives are to show how MANPRINT can be applied in the source selection process by assisting program managers and

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and their staffs in developing the source selection plan (SSP) and in formulating the request for proposal (RFP) and other solicitation documents.

MANPRINT

HANDBOOK FOR SOURCE SELECTION



"Remember the Soldier"

Department of the Army • Office of the Deputy Chief of Staff for Personnel

88 4 4 004

FOREWORD

The materiel acquisition process in the U.S. Army focuses on the performance of total systems. The MANPRINT program supports this process by seeking ways to enhance soldier performance within total systems. The MANPRINT perspective, therefore, plays an important role in evaluating industry proposals and selecting designs that will give the best value.

This procedural guide explains how MANPRINT considerations are applied in the source selection process. The guide discusses the responsibilities of the MANPRINT panel on source selection evaluation boards, the organization of that panel, and appropriate evaluation criteria.

When used with other guidance on acquisition, this procedural guide helps establish the role of MANPRINT in procuring integrated systems capable of producing the combat power needed to defeat the threat.

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Section 1. Introduction

1.1 General Aims of MANPRINT

The MANPRINT (manpower and personnel integration) program of the Army is a management and technical effort to integrate soldier performance and reliability issues into the materiel development and acquisition process. The program accomplishes this by continuously integrating information from the six soldier-related domains of MANPRINT. These domains are manpower, personnel, training, human factors engineering, system safety, and health hazards. MANPRINT contributes to total system effectiveness by orienting domain-related activities toward three goals: soldier performance, manpower utilization, and force effectiveness.

1.2 Purpose and Scope of Document

The purpose of this procedural guide is to show how MANPRINT is applied in the source selection process. In addition, the aim of the guide is to integrate MANPRINT considerations, to strengthen their linkage to the primary goals of the Army, and to give appropriate visibility to MANPRINT considerations in source selection decisions.

MANPRINT is only part of a larger effort to achieve total system performance. Contributions from engineering, logistics, MANPRINT, and other disciplines are balanced in the "best value" goal of the procurement process. Accordingly, this document is offered as a supplement to other, more comprehensive guidance on source selection. Furthermore, this document does not offer specific procedures for source selection since these procedures must be tailored to each acquisition.

Within this general purpose and context, the objective of this guide is to aid members of source selection evaluation boards (SSEB) in identifying and evaluating the MANPRINT content of proposals that are received from industry. Secondary objectives are to assist program managers and their staffs in developing the source selection plan (SSP) and to aid in formulating the request for proposals (RFP) and other solicitation documents. Those who will find this publication useful include combat, materiel, and training developers; testers and evaluators; industry; and designated MANPRINT managers and technicians.

1.3 Responsibilities

AR 602-2, Manpower and Personnel Integration (MANPRINT), outlines specific Department of the Army Headquarters (HQDA) and major command (MACOM) responsibilities for the MANPRINT program.

The Army Materiel Command (AMC) and the Training and Doctrine Command (TRADOC) are the main participants in the source selection process. TRADOC documents, such as the Mission Area Analysis, Operational and Organizational Plan (O&O Plan), Required Operational Capability (ROC), and System MANPRINT Management Plan (SMMP), are major source documents for AMC and others who prepare the system specification, SSP, draft RFP, and, eventually, the RFP. The individuals selected to join the MANPRINT panel come from several subordinate commands throughout the Army that specialize in the various MANPRINT domains.

1.4 Changes and/or Recommendations

Readers are encouraged to recommend changes, deletions, and additions to this guide. All proposed alterations should be submitted on DA Form 2028, Recommended Changes to Publications and Blank Forms, to HQDA, ODCSPER, Attn: DAPE-MR, Washington, D.C., 20301-0300.

Section 2. Organizing for MANPRINT Evaluations

2.1 General Approach

MANPRINT (manpower and personnel integration) is reported separately in source selection proceedings by means of a report sent directly to the chairman of the source selection evaluation board (SSEB). This report assures that MANPRINT has visibility equal to major evaluation areas, such as technical, management, and cost, and will be given appropriate consideration by higher-level decision makers. Due to its integrating role as well as its reporting status, the MANPRINT evaluation activity as a whole is not joined to or subsumed under any other activity.

The specific approach used to evaluate MANPRINT will vary according to the nature of the item being acquired, the phase of the acquisition process, the complexity of the evaluation tasks, and the acquisition pattern chosen. (This last issue is considered separately in section 4, Acquisition Alternatives, of this handbook.)

2.2 Planning for Source Selection

Early MANPRINT participation in the acquisition cycle can increase the influence of MANPRINT in the selection of contractors. As a specific strategy, MANPRINT practitioners should position themselves to influence the source selection plan (SSP). This plan, prepared by the materiel developer and program manager, describes the source selection organization and the evaluation criteria that will be stated in the request for proposals (RFP).

The document that most heavily influences source selection proceedings is the RFP. If comprehensive MANPRINT requirements are not inserted in the RFP, the industry offerers may not

respond to the requirements in proposals, and the scope of the eventual MANPRINT evaluation will be limited. The evaluation criteria stated in the RFP are the criteria that the SSEB must use when judging proposals. (The preparation of the RFP is dealt with at length in the publication MANPRINT: Handbook for RFP Development.)

These planning activities should be on the agenda of the MANPRINT Joint Working Group and should be reflected in the System MANPRINT Management Plan.

2.3 Source Selection Evaluation Board Organization

The SSP describes an organization in which MANPRINT evaluators play a role. Many options are available as long as the plan follows the principle that MANPRINT has an integrating role and is reported separately to the chairman of the SSEB.

In small acquisitions, there may not be a separate panel of MANPRINT evaluators but instead an individual or possibly a group who perform other parts of the evaluation as well. When a separate MANPRINT panel is used, it will vary in size to match the size and complexity of the evaluation task.

The broad nature of MANPRINT and the way in which it cuts across many areas of evaluation justifies the MANPRINT panel having a coordinating role and access to parts of the proposal that are the primary responsibility of other panels. The MANPRINT panel will often negotiate with other panels to share the evaluation of MANPRINT topics. In addition, the SSEB chairman will share responsibility for considering systems integration. Because of these coordinating and integrating functions, the MANPRINT panel should avoid the tendency to set strict boundaries to an area of evaluation and to attend only to that area. In other words, the status that the MANPRINT panel

has been given does not imply that it should organize itself according to the pattern of other major panels. If organized as other panels, the MANPRINT panel may not fulfill its unique integrating role.

Figure 1 shows three plausible organizations for major acquisitions that take the special nature of MANPRINT into account. The boxes refer to evaluation topics and subtopics and make no assumptions about the number of people or weight associated with these topics. In option 1, the MANPRINT evaluation topics are all understood to be part of the responsibility of other panels. Those responsible for the MANPRINT evaluation report participate on the panels, collect the results for MANPRINT-related subtopics, and synthesize these results in the consolidated MANPRINT report to the chairman.

In option 2, MANPRINT is considered the equivalent of an evaluation area, and the MANPRINT panel has sole responsibility for certain evaluation subtopics. The panel continues to perform its integrating function by consulting with other panels, but there is less emphasis on sharing specific evaluation tasks.

An intermediate arrangement is depicted in option 3. The MANPRINT panel has significant independent evaluation responsibilities, but the panel also shares many tasks with the other panels and for this reason is not grouped with the traditional areas of evaluation.

2.4 MANPRINT Panel

The following panel guidelines should be interpreted flexibly. One should bear in mind, however, the previously mentioned principles that govern the status of the MANPRINT panel within the SSEB. (The following discussion of panel organization is not comprehensive but instead highlights the way MANPRINT is

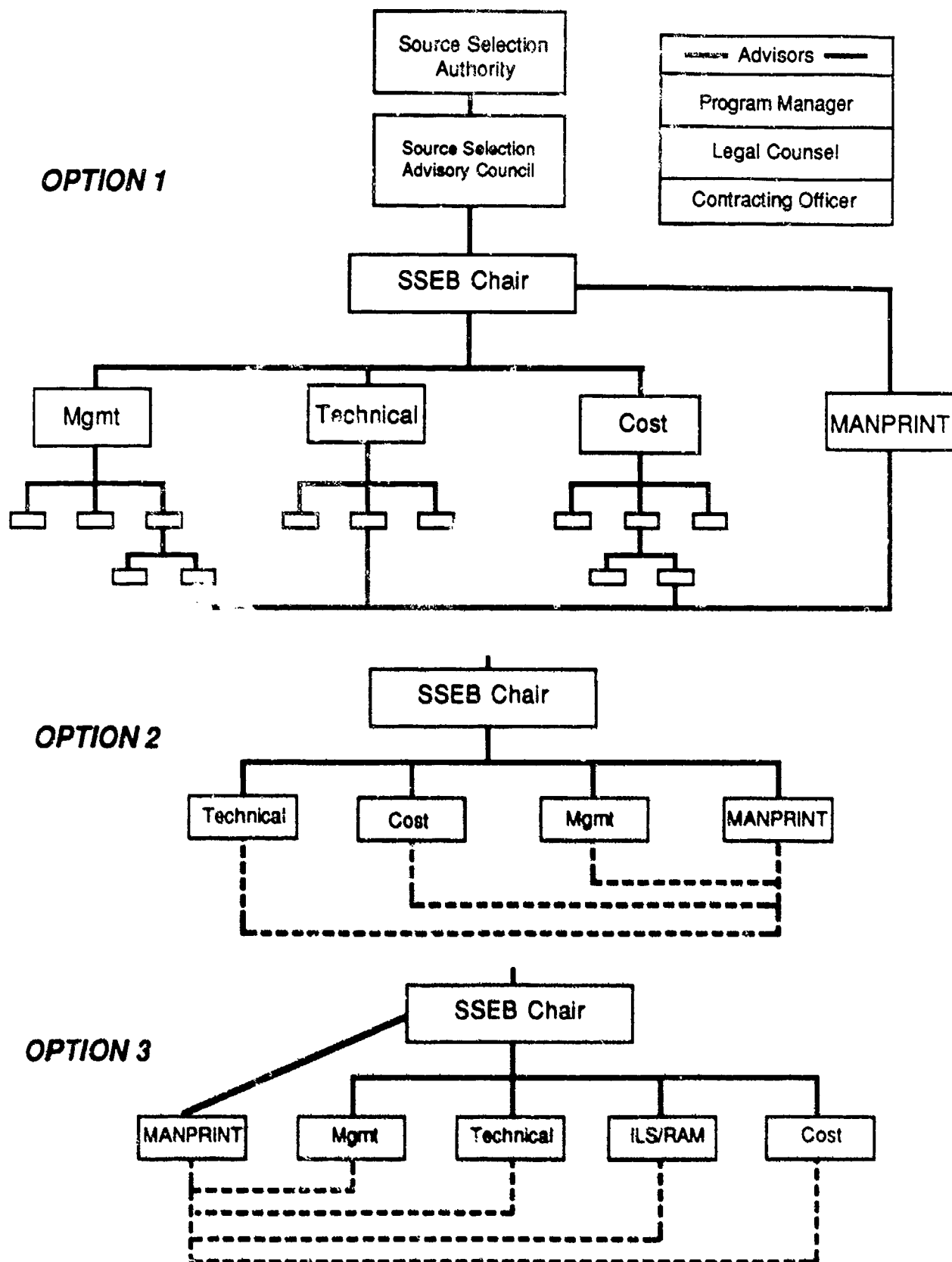


Figure 1. Optional Source Selection Organizations

accommodated. For a general treatment of SSEB activities, see AMC Pamphlet 715-3, The Source Selection Process, and DoDD 4105.62, Selection of Contractual Sources for Major Defense Systems.)

2.4.1 Panel Staffing

The MANPRINT panel director is recommended for appointment by the SSEB chairman, his deputy, and (if one is established) the Source Selection Advisory Council (SSAC). The program manager also advises these officials. The MANPRINT panel director should meet the following qualifications.

- o An additional skill identifier (ASI) of 6S for commissioned officers, appropriate Army civilian supporting qualifications, or attendance in an Army MANPRINT training course. Other recommended courses are the contracting officer's course and the course in writing statements of work
- o Experience with two or more MANPRINT domains and an understanding of the interactions among all the domains
- o Experience in the functional area in which the system will be used (for example, aviation background for aviation systems)
- o Previous experience with source selection and RFP development

It is recommended that the director of the MANPRINT panel be a U.S. Army Training and Doctrine Command (TRADOC) officer--especially at the early and middle phases of acquisition where strong user representation is most needed. (The TRADOC system manager, in particular, should be considered a candidate for directing the panel.)

The duties of the panel director include the following.

- o Review and approval of the panel's evaluation report
- o Development and interpretation of source selection criteria

- o Selection of qualified panel members
- o Refresher training of panel members (thereby increasing the skills within the pool of MANPRINT panel candidates)
- o Advocacy of MANPRINT interests to the SSEB chairman
- o Liaison with other panels on technical issues of system integration

Many of these duties require good communication skills and are enhanced if the director is well known in the development community. Since TRADOC officers have not interacted widely with the materiel development community up to this point, this qualification may initially be a goal rather than a requirement.

Initial qualifications for panel members include

- o Completion of MANPRINT training
- o Expertise in one or more of the MANPRINT domains
- o Familiarity with the type of system being considered

Members are responsible for drafting clearly stated and thoughtful reviews under short deadlines. While members are expected to contribute as specialists, members must be alert to the need to integrate all six MANPRINT domains. Sometimes experts in each domain are unavailable. Therefore, the members must be able to extend their valuations to include subject matter outside of their primary areas of expertise.

2.4.2 Panel Organization

The SSP will describe how the MANPRINT evaluation elements are divided and subdivided. The panel director will often have discretion over the interpretation of an evaluation element. Specifically, he may add clarifications that are consistent with

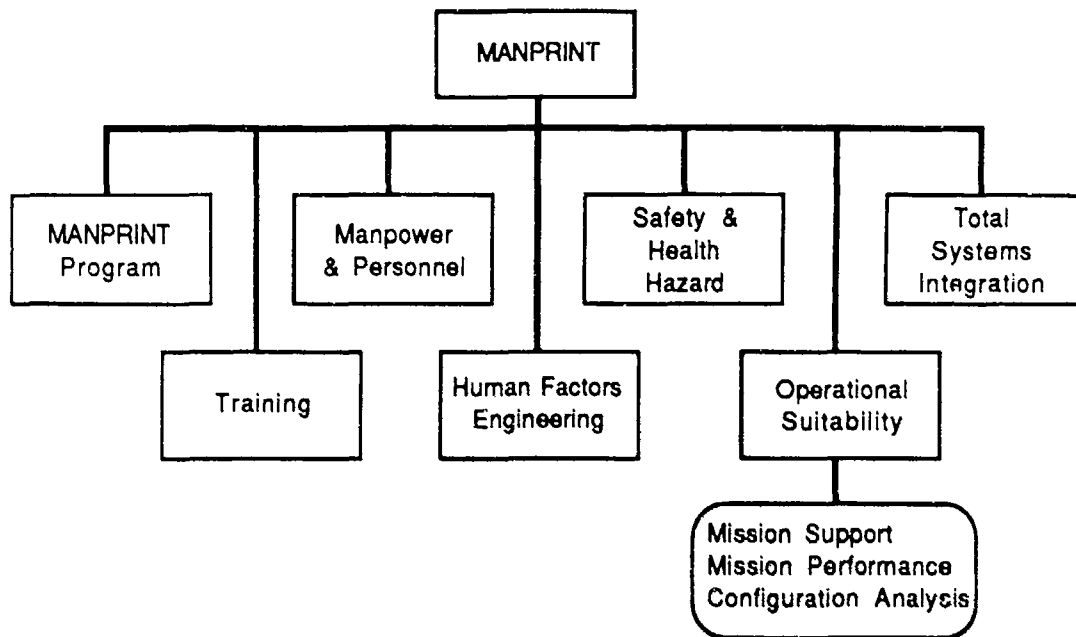
the RFP and seek to measure the offeror's responsiveness to the RFP.

Figure 2 shows two plausible methods of differentiating MANPRINT into elements and factors. Neither scheme in the figure has a large number of items. A limited number of items is recommended; since the creation of many divisions at each level of evaluation can complicate decision-making and report preparation. Note also that the six MANPRINT domains may be grouped and relabeled; it is not necessary to structure the evaluation according to the six traditional domains. The division of MANPRINT into elements is sometimes reinforced by a division of the panel membership into corresponding subpanels.

The MANPRINT panel, due to its concern for systems integration, must recognize its responsibility to coordinate with the other panels. The panel director can begin this coordination by identifying overlapping interests with other panels and by proposing a plan (during initial training and organizing sessions) to handle the overlaps. Two panels may agree to divide a topic and combine their scoring and reporting, or they may simply agree to discuss shared concerns and to exchange information. For example, once preliminary technical evaluations are complete, the cost panel will often provide manpower loading charts to help the MANPRINT panel validate an offeror's level of effort in performing MANPRINT tasks. The general aim of this coordinating activity is to ensure comprehensive coverage, to identify discrepancies and problematic interactions in a proposed design, and to provide more extensive coverage of the human implications of design.

Panel organization will vary in response to task complexity. The bayonet, a relatively simple item, has little impact on manpower, personnel, and health hazard issues. Yet, because of its function as a multipurpose hand tool, human factors engineers

ALTERNATIVE A



ALTERNATIVE B

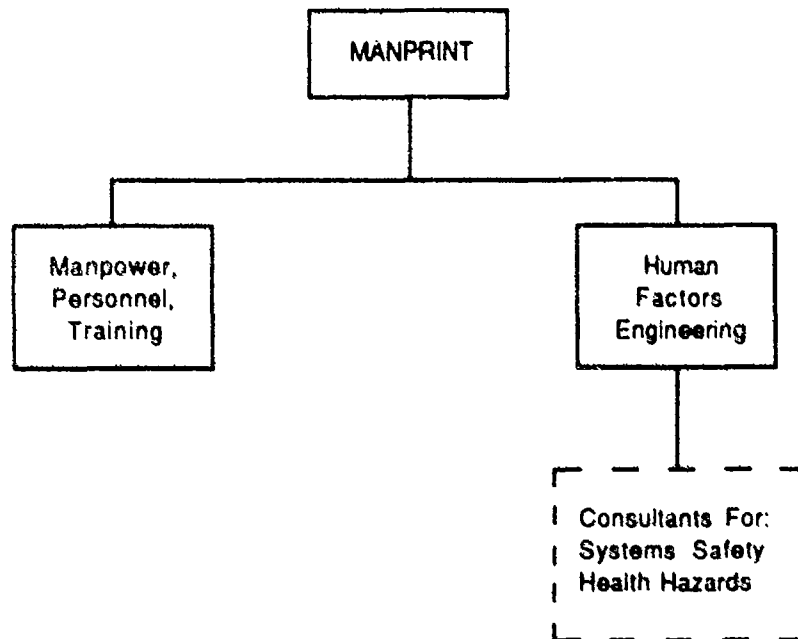


Figure 2. MANPRINT Panel Organizations (2 Samples)

will be greatly concerned with the design of the bayonet. Evaluators should consider, for instance, whether primary functional requirements are met without compromising secondary functions, such as wire cutting. Other significant topics will be training, MANPRINT management issues, and the integration of the item with other soldier equipment. These topics could be put into two equally weighted elements: human factors engineering and systems integration. The panel may decide not to subdivide itself to consider these two elements. Figure 3 shows how the panel would be organized for this particular example.

More complex systems, such as crew-served weapons, often have a large impact on the force structure. The large number of issues involved may lead to the formation of subpanels. By having representatives from many different Army organizations on the subpanels, judgments concerning wide-ranging issues, such as personnel, can be coordinated. A training subpanel, for example, may divide its evaluation tasks according to the organizational structure used by the Army. These considerations are reflected in the panel organization shown in figure 4.

The phase of acquisition creates additional implications for the organization of a panel. The concern at milestone I, is to select a contractor that will prove the validity of design principles against requirements. At milestone II, the concern shifts to selecting a design that will be taken to full-scale development. At milestone III, the Government selects a production contractor.

In the case of the bayonet, the initial focus on human factors engineering (HFE) may be relaxed in production phase acquisitions; because HFE issues will normally have been resolved at this point. If other MANPRINT issues do not have a counter-vailing gain in importance, the MANPRINT area may have less responsibility. On the other hand, in later phases of the crew-

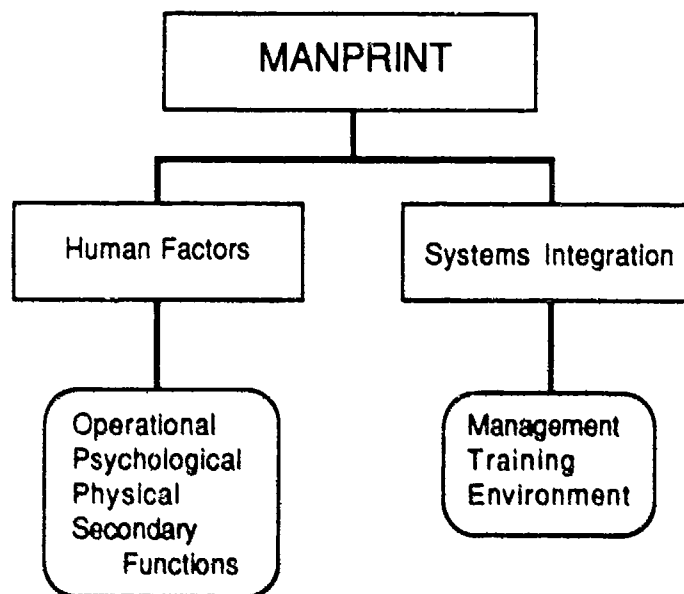


Figure 3. Panel Organization for Small Arms

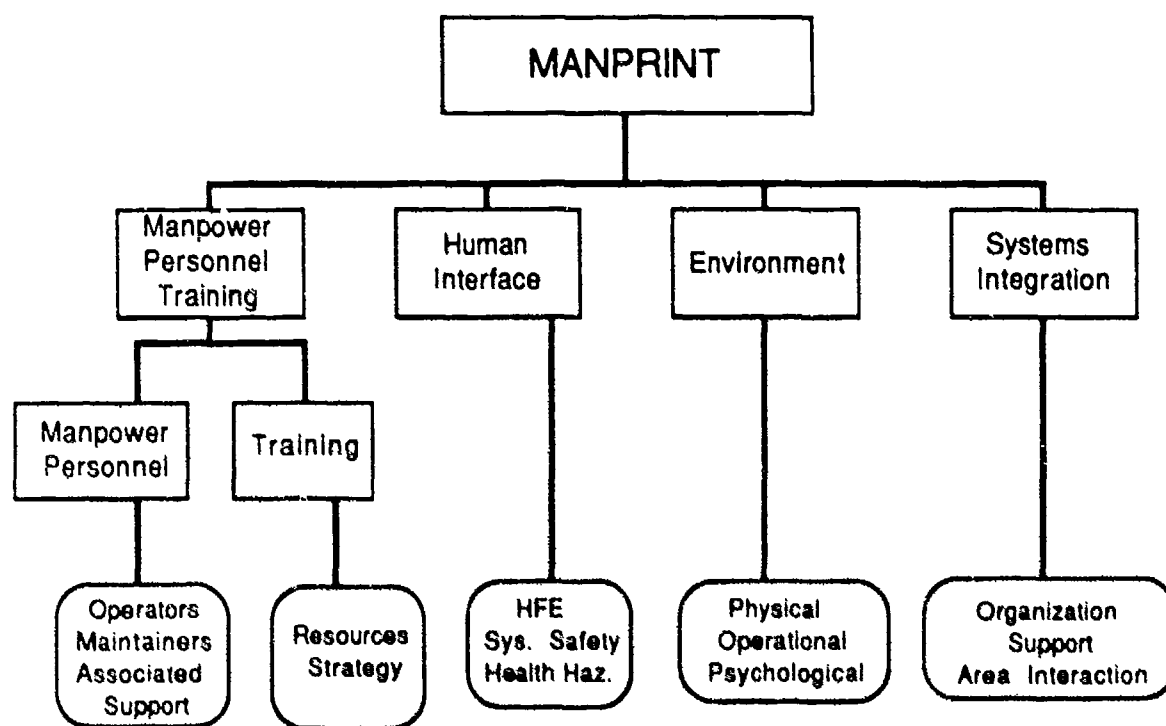


Figure 4. Panel Organization for Crew-Served Weapon

served weapon acquisition, MANPRINT issues may continue to be salient in the selection process. This could be because human aspects of supportability remain an issue or important data will have become available that need to be reviewed by the panel.

It should also be noted that large systems, such as crew-served weapons, typically have modifications included in later phase contracts. These modifications (preplanned product improvements and engineering change proposals) often demand continued MANPRINT attention.

2.4.3 Panel Conduct

The objective of the panel's evaluation is to judge how well proposals respond to the MANPRINT requirements in an RFP, based on a thorough examination of the proposals. A thorough examination requires that the panel gain access to all relevant parts of the proposals (which sometimes include videotapes, mockups, and site visits). MANPRINT concerns, whether or not they are designated as such in the offeror's proposal, may occur in any section. An Army policy statement of June 1987 directs this broad sweep on the part of offerors and evaluators alike: "Offerors will be instructed by the solicitation to address MANPRINT in every applicable portion of their offers and as a separate major portion of its own." Because many proposals are quite long, evaluators often review proposals in entirety quickly and index the parts that apply to MANPRINT.

Early in the evaluation, the SSEB will make sure that the proposals are complete. The MANPRINT panel may ask offerors for missing material via the formal "omissions, clarifications, and findings" procedures. To do this, the panel submits written questions through top officials to the contracting officer. The contracting officer presents the questions to the offeror. These questions must be carefully worded to avoid improper influence

over the candidate's responses; otherwise the legal counsel will dismiss them.

Once a group of technically acceptable proposals has been assembled, the contracting officer may conduct "meaningful discussions." The MANPRINT panel can be very helpful at this point by identifying weak portions in a proposal that the Government may not want to accept in a proposal that is excellent overall. Discussions may proceed through several rounds, and the offeror may submit several revisions before submitting a "best and final" proposal. In addition to keeping a complete audit trail of its own deliberations, the MANPRINT panel must be diligent in tracking changes that the offeror makes in each round and must be certain that these changes are reflected in the final statement of work of the contract. Even small changes in wording can have large effects. For instance, the usage of "shall" indicates a contractual requirement. Statements using "will" or "should" indicate intentions that are not contractually required.

2.4.4 Judgment and Weighting

The weight given to MANPRINT criteria is set in the SSP. In general, the weight varies depending on whether human performance strongly influences the performance of the system in realistic environments. An ammunition acquisition, for example, may weigh MANPRINT less; because the soldier's influence over performance (that is, whether a round fires or misfires) is small. In the case of a shoulder-fired weapon system, in which ammunition is only a subsystem, a higher weight on MANPRINT would be appropriate. In this case, performance hinges on whether the soldier can expect to hit targets during combat, not simply on whether the weapon fires accurately under laboratory bench-rest conditions.

Once members have collected sufficient information from the proposals, they will be prepared to judge each proposal against

the evaluation criteria in the RFP. The judgment may be expressed by choosing a word from an adjectival scale, such as "meets, exceeds, or does not meet" requirements, with no numbers associated. It is important to assure during early panel meetings that panel members have the same interpretation of the adjectival or numerical scale.

Numeric weighting is often preferred, but this approach should be used with care; because numeric summarization techniques can introduce unintended biases.

MANPRINT is problematic with respect to weighting; because some MANPRINT criteria are not mutually exclusive among themselves or with respect to criteria used by other panels. This criteria-related problem opens the possibility for inadvertent double-weighting. The MANPRINT panel director should coordinate with other panels to divide overlapping responsibilities so as to avoid double-weighting and redundant effort. Primary responsibility for training criteria, for instance, should be in MANPRINT where the bulk of human resource topics can be handled in an integrated fashion. Other topics closely related to MANPRINT may sometimes remain primarily under the responsibility other areas.

The MANPRINT panel should also compare each proposal against MANPRINT requirements as a whole. This is a final check on whether the offeror is truly responsive to the MANPRINT requirements. This holistic judgment may clarify general patterns in a proposal that are not addressed by any single factor or element.

The evaluation report that the MANPRINT panel sends directly to the SSEB chairman contains ratings for each proposal and written commentary to explain and justify these ratings. The comments assure the chairman of the accuracy and fairness of the judgments.

Section 3. Proposal Review Criteria

3.1 Introduction to MANPRINT Criteria

The criteria listed in this section are presented from three main perspectives. The management criteria have a procedural orientation and focus on the offeror's competence in carrying out a MANPRINT (manpower and personnel integration) program. The domain criteria, a longer list, follows the six traditional MANPRINT domains. The systems integration criteria consider the system as a whole and examine subsystem and super system interactions.

The criteria are tied to total system performance and are often derived from regulations and standards as they contribute to total system performance. The criteria, however, should not be used as an unchanging checklist applicable to all systems. For any actual system, the list of criteria will be tailored to keep at the forefront critical issues that affect the engineering design. Illustrations of such recombinations and system-specific formulations are shown in a final section on other environmental criteria.

This section is written under the assumption that before issuing a request for proposals (RFP), the Army has determined a performance standard for the system. Typically, this standard reflects the intention of the Army to design an item that can be used to defeat the enemy in battle situations but, also, can be preserved and used in unusual situations or from degraded conditions. Standards along these lines will subsequently be reflected in RFP requirements.

Well-stated requirements will describe performance characteristics without going so far as to dictate design decisions--thereby limiting the options and creativity of offerors. The

requirements will also be specific, feasible, desirable (that is, relevant to needs), and measurable.

Well-stated requirements are the foundation upon which to base the evaluation criteria that are formulated initially in the SSP and issued to industry through the RFP. The criteria are the means by which proposals will be judged on how well the offeror is likely to meet the requirements. For example, at early milestones, the evaluation criteria will focus on an offeror's method for meeting the requirements, not simply on the offeror's intention to do the work. Evaluation criteria in later phase acquisitions, where tasks are more routine, will emphasize production experience and if the means are in place for successfully accomplishing the RFP requirements.

More specific indicators may be used to help measure if a criterion has been met. These indicators serve as an operational definition of a criterion, and the indicators are established through panel discussion or from guidance in the source selection plan (SSP). Most of the criteria listed below are not described in specific detail, which would only make sense in the context of a specific system. Such operational indicators are useful wherever the interpretation of a criterion is unclear or is controversial. At the same time, the indicators should allow for innovative responses that fall outside a standard pattern.

Sometimes an offeror will have performed some of the required work as a demonstration of competence. The source selection evaluation board (SSEB) should not encourage this work if it represents uncompensated labor that is not called for in the RFP. Evidence of such work in a proposal should not be evaluated more highly than an excellent plan for doing work that the contract intends to compensate.

The expert judgment of panel members must rely upon whatever criteria are used. An excessive number of criteria or over-reliance on operational measures of responsiveness can sometimes become a distraction to evaluators in judging a proposal fairly and in the interest of the Government. As stated in DoDD 4105.62, "Excessive subdivision of criteria should be avoided to preclude an unnecessarily detailed assessment that obscures significant differences among proposals"

3.2 Management Criteria

The following criteria relate to the evaluation of the offeror's capability to perform MANPRINT tasks and to control the development process. Recall that no criteria that are not stated in some form in the RFP may be used by SSEB evaluators, and criteria must be closely related to work requirements in the RFP. Also, it is not intended that all of the following criteria would be used at any single evaluation.

MANPRINT Program

Planning

- o Adequacy of offeror's MANPRINT organization, level of effort, lines of authority, visibility to top management, and potential impact on design decisions
- o Adequacy of offeror's concept for contributing to and helping to execute the System MANPRINT Management Plan of the Army

Execution

- o Coordination of MANPRINT activities with the total management system and work breakdown structure

- o Coherence of offeror's plan for tracking and reporting MANPRINT task performance and for assuring quality

Evaluation

- o Adequacy of offeror's methodology for meeting MANPRINT validation requirements as part of the test and evaluation requirements in the RFP
- o Adequacy of test and evaluation facilities

Technical Qualifications

- o Quality of offeror's and subcontractor's previous experience in MANPRINT-related tasks (that is, corporate background).
- o Capability of offeror's personnel (including key subcontractor personnel) to perform required MANPRINT tasks, including personnel capabilities in the separate domains of MANPRINT

Operations and Support (O&S) Cost Evaluation (not contract costs)

- o Adequacy of offeror's analysis of system costs and projections in relation to MANPRINT topics
- o Adequacy of offeror's cost tradeoff analysis (investment versus sustainment or research, development, testing, and evaluation (RDT&E) versus O&S) in meeting MANPRINT-related requirements

MANPRINT Understanding

- o Offeror's understanding of MANPRINT concepts as a means for enhancing total system performance
- o Adequacy of offeror's concept for assuring that the system design will reflect MANPRINT goals and constraints

3.3 Domain Criteria

Criteria listed in this section are organized according to domains derived from traditional institutional divisions within the Army. The criteria listed within each domain focus on issues that influence system design and total system performance. In any specific evaluation, not all the criteria will achieve this level of significance, and, again, no criteria may be applied that are not shown in the RFP.

3.3.1 Manpower Domain Criteria

The offeror must demonstrate an understanding of force structure constraints and analyze the direct and indirect impacts of the proposed system on the current force.

The following additional criteria reflect aspects of manpower that may have been mentioned in the RFP.

- o Includes adequate approach to reducing manpower needs while maintaining desired system performance
- o Includes adequate plans for analyzing tradeoffs among design options that could produce savings in manpower and costs, informing the Government of results and making appropriate design changes
- o Addresses the impact of varying manning levels on total system performance

Offerors may be asked, when making presentations on these topics, to use appropriate data from Early Comparability Analysis (ECA), Hardware Versus Manpower/Man Integrated System Technology (HARDMAN/MIST) studies, and the Qualitative and Quantitative Personnel Requirements Information/Basis of Issue Plan (QQPRI/BOIP) and to consider applicable regulations such as AR 570-4, Manpower Management.

3.3.2 Personnel Domain Criteria

The offeror should demonstrate an understanding of the personnel implications of the design and be aware of the constraints placed on the Army to provide personnel with specific skills, experience, and other characteristics needed for operation, maintenance, and support.

The following criteria indicate additional aspects that may warrant evaluation, depending on if corresponding requirements were included in the RFP.

- o Demonstrates an understanding of the Target Audience Description and the MANPRINT goals and constraints that are imposed by the description
- o Shows ability to alert the Government to the use of Military Occupational Specialties (MOS) and Career Management Fields (CMF) that present recruiting and retention difficulties or are low in density and would be difficult to expand quickly
- o Includes adequate plans for identifying the human-resource-intensive aspects of the system and explains how alternative designs will be pursued
- o Plans to identify and clarify personnel burdens during design work
- o Addresses the impact of varying soldier quality levels on total system performance
- o Avoids narrow definition of the soldier--accommodates experts and novices, active component and Reserve/National Guard, and creates responsive system for all
- o Identifies skills that are critical to successful mission performance and explains how these skills relate to the capabilities of the soldier as detailed in the Target Audience Description

When responding to these criteria, the offeror may find it useful to consider findings in ECA, HARDMAN analysis, and other personnel studies. The Army, for its part, must ensure that all

offerors are aware of and have access to the relevant personnel information.

3.3.3 Training Domain Criteria

The offeror must understand the training requirements for the system throughout the total force and should have a robust plan for developing training.

Additional criteria, such as the following, point to possible requirements that are important in an integrated development program.

- o Indicates how the in-house training developer will serve as a source for design ideas and as a check on design
- o Understands the impact of design on training devices and other aids
- o Recognizes the impact of skill decay rates on sustainment training and demonstrates capability for reducing skill decay through cost-effective changes in the design
- o Recognizes the influence of soldier aptitude on success in training and, in turn, on system performance (plans to use personnel analysis to guide training design)
- o Accommodates the need for cost-effective practice at dispersed locations as well as needs for initial entry training
- o Includes an adequate plan for evaluating training options aimed at saving resources while maintaining unit readiness

The offeror may be asked to refer to service school surveys, task analyses, and other appropriate studies and data that are made available by the Government. AR 350-35, Army Modernization Training, and other applicable regulations may be consulted.

3.3.4 Human Factors Engineering (HFE)

The offeror should present plans and methods to match humans with machine designs in a way that enhances total system performance. The following criteria examine other HFE-related aspects of proposals that might be called for in the RFP.

- o Includes an adequate plan for functional and/or task analysis and critical task identification to determine appropriate task burden for the soldier
- o Shows approach for tracking the functions, information flow, and processing steps that the operator must monitor
- o Includes an adequate plan for estimating physical and cognitive workloads of operators and maintainers, by group and individually, with reference to manpower, personnel, and training constraints
- o Allocates functions to soldier, machine, and software for optimal system performance
- o Addresses the design of the work environment, including space claims and other workstation variables, as the work environment influences system performance
- o Ensures that human engineering testing and evaluation plans use valid equipment and techniques such as mockups, simulation, models, prototypes, etc.
- o Includes plan for devising effective and safe procedures for equipment use and maintenance
- o Plans to conduct failure analysis and documentation of redesigns made in response to failure

The offeror may be asked to use techniques and guidance outlined in various publications, such as MIL-H-46855, Human Engineering Requirements for Military Systems; MIL-STD-1472 Human Engineering Design Criteria for Military Systems, Equipment and Facilities; and MIL-HDBK-759 Human Factors Engineering Design for Army Materiel.

3.3.5 System Safety Criteria

The offeror plans to account for safety hazards that threaten system performance, and, where possible, eliminate these hazards through early design changes.

The following additional criteria may be appropriate, given corresponding requirements in the RFP.

- o Plans to identify potential safety hazards in all environments over equipment life cycle and documents accepted residual risks
- o Estimates severity and frequency of accidents
- o Generates options for reducing risk through redesign and retrofit and allocates effort to those options
- o Accommodates peacetime safety standards for operation but does not, as a consequence, degrade wartime operational capability
- o Demonstrates a plan for tracking changes in design and for continuously evaluating safety impacts
- o Plans to solicit user's position on acceptable risk and estimates influence of these risks on operator/maintainer performance
- o Identifies methods in which mechanical subsystems can be operated safely when the performance of human subsystems is degraded

The offeror may be asked to refer to MIL-STD-882 and the System Safety Assessment Report.

3.3.6 Health Hazards Criteria

The offeror should plan to identify health hazards that may degrade total system performance and, where possible, eliminate these hazards through early redesign.

The following criteria may reflect specific RFP requirements.

- o Demonstrates an understanding of health hazard assessment, including survivability, casualty assessment, and second-order impacts on manpower and personnel decisions
- o Plans to identify psychological influences on soldier performance that can be controlled favorably through system design
- o Evaluates hazards in various operating environments and determines priorities for control through initial design and retrofit
- o Identifies alternative technical concepts to control, reduce, or avoid health hazard risks
- o Demonstrates ability to prepare test and evaluation plans using state-of-the-art practices, criteria, standards, and biomedical data bases
- o Demonstrates coordination with health and related organizations in the Army and elsewhere

3.4 Systems Integration Criteria

The MANPRINT panel may cover the separate domains adequately, but a remaining issue is whether the offeror has employed a total systems perspective. An effective systems approach is not easily specified, but there are some basic principles that are useful in most situations. The system itself must be accurately and consistently defined to include human operators and maintainers and any equipment that is closely associated with the central item. Such a definition allows for a clearer analysis of the interaction of the system with larger systems and environments, an important concern that is often overlooked in traditional analysis. (Some terms that have been used to indicate this focus are macro-ergonomics and socio-technical systems.) Distinctions and interactions between components in the system, particularly between human and mechan-

cal components, are often a source of problems that are not visible when components are studied in isolation.

Another advantage of the systems approach is that, because the functions of the system are kept in focus, the overall performance objectives can achieve a controlling influence over design. The whole system is not allowed to fall into suboptimal performance; because relevant functional measures are used and the performance of components is not overemphasized. MANPRINT must consider, in particular, whether the human is integrated such that his strengths are enhanced and weaknesses accommodated to maximize total system performance.

The offeror may be asked in the RFP to show plans that could be evaluated by the following criteria.

- o Assures integration of man and machine within a system (for example, engineering decisions should be made with constant reference to soldier performance, and system functions should be matched to human attributes during task allocation.)
- o Assures that performance of a focal system is consistent with the performance and goals of larger enclosing systems (for example, shows how soldier goals and performance contribute to weapon system performance, which in turn contributes to unit/force effectiveness and underlying doctrine)
- o Shows that tradeoff analysis and sensitivity analysis is used to evaluate design alternatives--The design alternatives range from whole technologies to component substitutions, and the performance comparisons can be made as follows.
 - Between areas (for example, MANPRINT versus technical versus reliability, availability, and maintainability (RAM))
 - Between MANPRINT domains (for example, training versus safety)

- Within MANPRINT domains (for example, choice between favoring false negative or false positive sensor readings)
- o Presents valid performance tests of the system in realistic and anticipated environments and combinations of environments (for example, the questions of if the soldier can operate controls after rain and freezing weather and if active radio traffic will delay priority transmissions to and from the focal system).
- o Plans to evaluate opportunities to decouple mechanical and human subsystems, so component failures do not disable the system quickly or fully and assures that recovery procedures are available to front-line soldiers
- o Shows that system design and MANPRINT analysis will be performed iteratively, so that problems are fed back and, if possible, eliminated early in the design phase--Offeror will track changes in design and continuously evaluate domain impacts.
- o Plans efficient conduct of fundamental data collection, analysis, and interpretation--Offeror should devise methods of combining tests, sharing data, or performing multipurpose research to meet requirements without duplication of effort. (A plan for task analysis, for example, anticipates the several uses of the data and designs data collection procedures accordingly.)
- o Takes into account all dimensions and full extent of the system, including the following.
 - Late life-cycle costs--Offeror guards against using immediate efficiencies that create later burdens.
 - Maintenance and repair as well as operations
 - Use and training by Reserve/National Guard
 - Additional support items of equipment (ASIOE)

3.5 Other Environmental Criteria

The management, domain, and systems integration perspectives offer broad coverage, yet other perspectives can be used when evaluating compliance with MANPRINT-oriented requirements in the RFP. The criteria described in this section tend to relate to

the operational, physical, or social environment in which the system will perform.

The social environment encompasses leadership, stress, user acceptance, and so forth. To indicate how these issues can affect design, consider a soldier's fear in isolated situations. Partly to avoid putting a soldier in this situation, many vehicles accommodate two persons, a driver and an accompanying person. User acceptance or rejection of an item can be influenced by subtle design features, such as a combination of reliability with look and feel, that either instill confidence or doubt during use. The point is that technical adequacy is no guarantee of acceptance.

The physical environment refers to conditions in the physical world as they affect the machine and soldier and degrade or enhance performance. These include effects from altitude, temperature, vibration, and motion caused by the terrain. An example is the decision whether to place a heater in a vehicle. The decision is influenced by if a cold driver compartment degrades the performance of the driver.

The operational environment refers to the ways in which fighting doctrine and other procedures affect soldier-machine designs. For example, the need for continuous and sustained operations results in human fatigue, and this raises the question of whether to add reclining seats in a vehicle as a means of relieving fatigue and therefore maintaining readiness. Other operational topics include MANPRINT implications of nuclear, biological, and chemical (NBC) warfare; command and control; and continued use of units that have suffered high attrition.

Other broad criteria may be taken up by a MANPRINT panel. One example, vulnerability, can be addressed from many perspectives. For example, the panel may address if the system design

allows for cover and concealment by having a low profile or by mimicking the sensor signatures of other machinery. Or the panel may question if the system has redundant controls or multiple functions that allow the soldier-machine system to continue making a contribution to the mission from a degraded condition. Operational suitability is another broad criterion that should not be neglected by the MANPRINT panel. Operational suitability is often contrasted with technical performance. Operational suitability is defined in DoDD 5000.1 as "The degree to which a system can be placed satisfactorily in field use, with total system operational and maintenance considerations being given to availability, compatibility, transportability, interoperability, reliability, wartime usage rates, maintainability, human factors, manpower, training, health hazards, safety, and logistic supportability."

Evaluators in other panels may claim issues mentioned in this section as their own. This is perfectly acceptable as long as the MANPRINT panel director is satisfied that the issue has not been arbitrarily curtailed to fit the confines of a specialty. The panel director should also ensure that, if his panel does claim the issue, the work of the panel is coordinated with other panels that may be covering related aspects.

A few examples of criteria follow. These criteria, if used, would be matched to requirements in the RFP.

- o Offeror shows a valid plan for demonstrating that operator communication functions can be automated to the extent that sufficient operator attention is available for other necessary tasks during periods of peak activity. (For example, a plan that demonstrates that a one-man helicopter crew can offload C'I tasks while flying and perform both tasks effectively)
- o Offeror shows a plan for determining if the new system, compared to its predecessors, will offer more performance at the same cost over the whole life cycle. (Offeror will have to plan to estimate many of the downstream manpower costs.)

- o Offeror is prepared to demonstrate that the new system, compared to its predecessors, reduces soldier vulnerability. (A response involves a plan for identifying failure modes and recovery procedures in the system and a plan for describing the soldier's ability to survive and adapt to these transitions.)
- o Offeror presents plans for identifying error conditions that are matched to a program for avoiding initiation of these error conditions through appropriate modifications in design or operator training. (This links testing to operational effectiveness and avoids conceiving of human error separate from the machine design. Following this approach, the "system error budget" could be defined to include operator errors that are influenced by the interface design.)

Section 4. Acquisition Alternatives

The Army uses a new procurement procedure, the Army Streamlined Acquisition Process (ASAP), which complements the Life-Cycle System Management Model (LCSMM) by offering a speedier sequence that implies adjustment in front-end analysis. The nondevelopmental item (NDI) strategy is for use where a full development cycle is not required. MANPRINT review remains a requirement under this alternative but must be modified.

A useful way of tracking the changes introduced by these alternative acquisition procedures is to focus on information: what information is needed, who needs it at what time, and how is the information collected.

4.1 Nondevelopmental Items

With developmental items, MANPRINT is focused on influencing design to achieve system performance. In the NDI process, MANPRINT is refocused on accepting, modifying, and testing a system that has essentially been designed.

A program that eventually becomes NDI starts the same as any other program with the identification of a deficiency through the Mission Area Analysis, followed by an Operational and Organizational Plan (O&O Plan) and a by a System MANPRINT Management Plan prepared by a MANPRINT Joint Working Group. Because the NDI procurement option is attractive in terms of cost and speed, this option will be considered before any further commitments are made. This is the beginning of the NDI decision process that is depicted in figure 5.

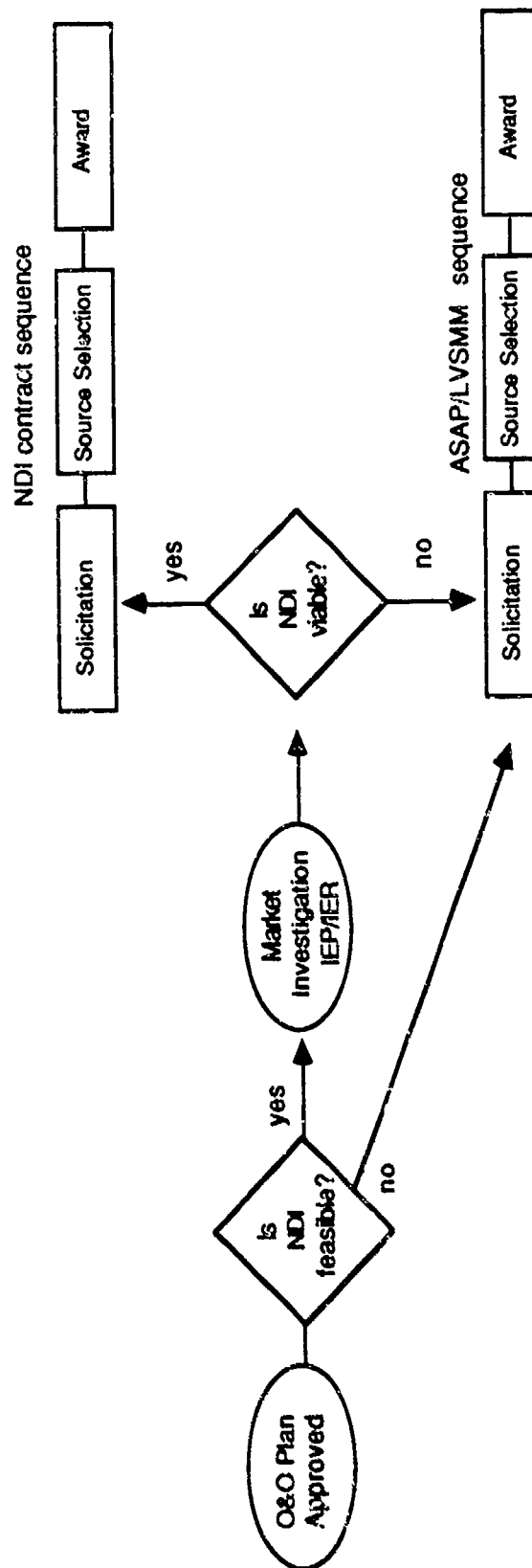


Figure 5. The NDI Process

An initial decision on if the NDI option is feasible and if further study is warranted must be made. This initial judgment is aided by information that has been collected during continuous marketplace surveillance. This information might consist of brochures from the manufacturer, specification sheets, and warranty statements, or there may be more extensive data, such as crash test reports and field test reports prepared by users, other services, and other governments.

Once NDI is judged to be feasible, a more extensive market investigation is begun. The question of if an NDI procurement is viable and feasible is addressed. In other words, a determination of if the procurement of existing technology truly meets Army requirements and avoids the added expense of development is made.

The key to assuring that MANPRINT is used as a discriminator at this stage in the NDI decision process is to insert MANPRINT evaluation issues in the Independent Evaluation Plan (IEP). The Independent Evaluation Report (IER) is the result of carrying out the IEP.

If critical MANPRINT issues and questions cannot be addressed during the preparation of the IER, based on information that is available, additional effort may be required. In some cases, the NDI decision will be delayed; Sample equipment will be purchased; and a test and evaluation will be conducted under the Concept Evaluation Program. Often, however, the determination of if MANPRINT goals and constraints are breached will be made solely on the basis of information gathered during market investigation and from offerors in response to solicitations. The information is rarely ideal. Warranty and other marketplace data for a commercially used item, for example, may meet the needs of industry but not help the Army estimate the effects of the item on force structure, workload, or personnel skill levels.

Simply put, information that is normally generated during the development process may not be available. The challenge is to devise, in the IEP and during market investigation, guidelines that will elicit sufficient MANPRINT domain information to permit an experienced professional to judge if the item meets requirements (with the understanding that normal specifications and standards will not be met in all respects).

If it is determined that an NDI solution is viable, additional data may be elicited from potential offerors for comparison against the MANPRINT evaluation criteria. Based on this information and on additional interests, such as the need to foster competition, the criteria are revised and are cited either in the first-step document of a two-step sealed bid or in a request for proposals (RFP) leading to a fixed-price negotiated contract.

MANPRINT influence in the NDI process hinges on the insertion of questions and issues used in the IEP and market investigation. An attempt should be made to resolve the issues based on existing, sometimes partial information, but MANPRINT practitioners should be prepared to stop the NDI process if serious deficiencies are found. If important issues cannot be resolved without more information, an effort must be made to obtain that needed information, even if obtaining the information requires testing that causes delays. A decision to proceed to the solicitation is therefore made with confidence that MANPRINT requirements will be met by the winning bidder.

The policy on nondevelopmental items is enunciated in AR 70-1, Army Systems Acquisition Policy and Procedures, while practical guidance is included in revisions to AMC/TRADOC PAM 70-2, Material Acquisition Handbook.

4.2 Army Streamlined Acquisition Process

AR 70-1 institutionalizes an Army Materiel Command/Training and Doctrine Command (AMC/TRADOC) initiative to achieve the "surest and shortest" path for low-risk developments. ASAP seeks to field relatively low risk developments that are evolutionary in nature with the promise that future capability needs can be achieved through preplanned product improvement (P³I). While ASAP shortens the development process, ASAP does so without losing safeguards essential to the decision process.

Before technology enters the ASAP process, the technology base of the Army may have already made significant investigations (including fabrication of breadboards and brassboards) to assure the Army that ASAP development will, in fact, have low risk and can proceed rapidly. Under this arrangement, MANPRINT practitioners should consider that technologies can be effectively influenced when they are under control of the technology base. With regard to the "battlefield of the future" investigations that are conducted by the technology base, it is critical that MANPRINT influence these wide-ranging concepts. The point is that MANPRINT should influence the very initial design attempts, wherever they occur, so that soldier performance will be integrated into the hardware/software design. Unless MANPRINT is considered in the technology base effort when relatively inexpensive to apply, MANPRINT will have to play catchup later in the development when changes are more costly.

All of the guidance provided in this document is applicable to ASAP and is not specific to the LCSMM process. The prime difference in ASAP is timing. Since ASAP compresses the acquisition cycle, the MANPRINT activity must be compressed also. The key to providing timely MANPRINT input to ASAP solicitations remains an up-to-date, meaningful System MANPRINT Management Plan (SMP) prepared by an active MANPRINT Joint Working Group (MJWG).

Section 5. Summary

This procedural guide relates MANPRINT to the source selection process. The main aim of the guide is to describe how MANPRINT concepts can be expressed in a set of evaluation criteria. A description of evaluation board conduct shows how the concepts and criteria are used.

MANPRINT practitioners need to contribute to the acquisition process at an early stage in order to influence the design of Army equipment. Practitioners also need to be involved in the preparation of the request for proposals (RFP) and in the source selection plan that sets the structure for source selection evaluation.

MANPRINT evaluation criteria are broad, covering the offeror's management plans related to MANPRINT tasks as well as the six specialty domains (manpower, personnel, training, human factors engineering, system safety, and health hazards). The panel director and members need to become conversant in all these domains and in their interaction to be effective advocates of the MANPRINT perspective.

An additional topic of evaluation is systems integration. This difficult task takes MANPRINT evaluators beyond a specialist orientation to an assessment of if interacting subsystems are integrated and especially if a proposed item of equipment can be used successfully, given the capabilities and limitations of Army manpower and personnel. In other words, systems integration criteria look beyond partial measures of performance toward total system performance in realistic situations. This concern of the MANPRINT panel implies a need to coordinate with other panels, such as the integrated logistics support/reliability, availability, and maintainability (ILS/RAM) or technical panel, whose

deliberations help decide whether the work proposed by an offeror is likely to produce an integrated system.

The organization of a MANPRINT panel may vary according to the item being considered, the complexity of the evaluation task, and the development stage of the system. A final consideration is the style of acquisition. The new standard, ASAP, quickens the pace by which MANPRINT-oriented testing must occur. The nondevelopment item further modifies the sources and priorities of MANPRINT test and evaluation information.

The constant theme of the MANPRINT initiative is total system effectiveness. In light of this goal, MANPRINT provides comprehensive coverage of the human dimensions of materiel acquisition at a time when the use of new technology is demanding more highly skilled personnel from an inelastic supply of manpower. This procedural guide illustrates how the MANPRINT initiative can be applied in source selection proceedings and in the larger materiel acquisition process.

Appendix A: List of Abbreviations and Acronyms

AFQT	Armed Forces Qualification Test
AMC	U.S. Army Materiel Command
AR	Army Regulation
ARI	Army Research Institute for the Behavioral and Social Sciences
ASAP	Army Streamlined Acquisition Process
ASI	Additional Skill Identifier
ASIOE	Additional Support Items of Equipment
ASVAB	Armed Services Vocational Aptitude Battery
BOIP	Basis of Issue Plan
BTA	Best Technical Approach
CMF	Career Management Field
COEA	Cost and Operational Effectiveness Analysis
DA	Department of the Army
DID	Data Item Description
DoD	Department of Defense
DoDD	Department of Defense Directive
DoDI	Department of Defense Instruction
ECA	Early Comparability Analysis
ECP	Engineering Change Proposal
HARDMAN	Hardware versus Manpower
HEL	Human Engineering Laboratory
HFEA	Human Factors Engineering Analysis
HHA	Health Hazard Assessment
ILS	Integrated Logistics Support
JMSNS	Justification for Major System New Start
KO	Contracting Officer
LCMM	Life Cycle System Management Model
LSA	Logistics Support Analysis
LSAR	Logistics Support Analysis Record
MAA	Mission Area Analysis
MACOM	Major Army Command
MANPRINT	Manpower and Personnel Integration
MAP	Materiel Acquisition Process
MEPSCAT	Military Entrance Physical Strength Capacity Tests
MIL-HDBK	Military Handbook
MIL-STD	Military Standard
MJWG	MANPRINT Joint Working Group
MOS	Military Occupational Specialty
MFT	Manpower, Personnel, and Training
MSC	Major Subordinate Command
NBC	Nuclear, Biological, Chemical
NDI	Non-development Item
ODCSPER	Office of the Deputy Chief of Staff for Personnel
O&O Plan	Operational & Organizational Plan
OTEA	U.S. Army Operational Test and Evaluation Agency
O&S	Operation and Support
P3I	PrePlanned Product Improvement
PAM	Pamphlet
PIP	Product Improvement Proposal

PM	Program Manager
QQPRI	Qualitative and Quantitative Personnel Requirements Information
RAM-D	Reliability, Availability, Maintainability, Durability
RDTE	Research, Development, Test, and Evaluation
RFP	Request for Proposals
ROC	Required Operational Capability
SAR	Safety Assessment Report
SMMP	System MANPRINT Management Plan
SOW	Statement of Work
SSA	Source Selection Authority
SSAC	Source Selection Advisory Council
SSAR	System Safety Assessment Report
SSEB	Source Selection Evaluation Board
SSEP	Source Selection Evaluation Plan
TAD	Target Audience Description
T&E	Test and Evaluation
TEMP	Test and Evaluation Master Plan
TRADOC	U.S. Army Training and Doctrine Command
TSM	TRADOC System Manager

Appendix B: References

Primary References

AFARS	(Army Federal Acquisition Regulation Supplement)
AR 15-14	System Acquisition Review Council
AR 40-10	Health Hazard Assessment Program in Support of the Army Materiel Acquisition Decision Process
AR 70-1	Army Systems Acquisition Policy and Procedures
AR 70-10	Test and Evaluation During Development and Acquisition of Materiel
AR 71-9	Materiel Objectives and Requirements
AR 350-35	Army Modernization Training
AR 385-16	System Safety Engineering and Management
AR 570-4	Manpower Management
AR 602-1	Human Factors Engineering Program
AR 602-2	Manpower and Personnel Integration (MANPRINT) in the Material Acquisition Process
AR 700-127	Integrated Logistics Support
AR 715-6	Proposal Evaluation and Source Selection
AR 1000-1	Basic Policies for Systems Acquisition
DA PAM 11-25	Life Cycle System Management Model for Army Systems
DA PAM 700-127	Integrate Logistics Support (ILS) Manager's Guide
DoDD 4105.62	Source Selection (9 Sept 1985)
DoDD 5000.1	Major and Non-Major Defense Acquisition Programs
DoDD 5000.3	Test and Evaluation

DoDD 5000.36	System Safety Engineering and Management
DoDD 5000.39	Acquisition and Management of Integrated Logistic Support for Systems and Equipment
DoDD 5000.43	Acquisition Streamlining
DoDI 5000.2	Major System Acquisition Procedures
DoD-STD-63	Military Standard: Data Item Description (DID) Preparation
MIL-HDBK-245	Preparation of Statement of Work (SOW)
MIL-HDBK-743	Anthropometry of U.S. Military Personnel
MIL-HDBK-759	Human Factors Engineering Design for Army Materiel
MIL-HDBK-46855	Human Engineering Requirements for Military Systems
MIL-STD-143	Standards and Specifications, Order of Preference
MIL-STD-490	Specification Practices
MIL-STD-961	Preparation of Military Specification and Associated Documents
MIL-STD 1388 1A/2A	Logistic Support Analysis
MIL STD 1472C	Human Engineering Design Criteria for Military Systems, Equipment and Facilities
MIL-STD-1474B	Noise Limits for Army Materiel
MIL-STD 8823B	System Safety Program Requirements
MIL-H-46855B	Human Engineering Requirements for Military Systems, Equipment and Facilities
AMC/TRADOC PAM 70-2	Materiel Acquisition Handbook, 1987
AMC/TRADOC PAM 70-7	Nondevelopment Item (NDI) Acquisition
AMC PAM 715-3	Source Selection

Other Publications

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